

## CLAIMS

1 1. A metallization stack in an integrated MEMS device, the metallization stack comprising:  
2 a titanium-tungsten layer that operatively contacts an electrically conductive  
3 structure in the integrated MEMS device, and  
4 a platinum layer formed over the titanium-tungsten layer.

1 2. The metallization stack of claim 1, wherein the electrically conductive structure is an  
2 active silicon element in a semiconductor substrate of the integrated MEMS device.

1 3. The metallization stack of claim 2 wherein  
2 the titanium tungsten layer contacts the active silicon element via a platinum  
3 silicide layer formed on the semiconductor substrate; and  
4 the semiconductor substrate has an insulating film formed thereon, the insulating  
5 film has a contact hole formed therein, the contact hole exposes a portion of the surface  
6 of the semiconductor substrate at a bottom of the contact hole and the platinum silicide is  
7 formed only on the exposed portion of the surface of the semiconductor substrate.

1 4. The metallization stack of claim 3 wherein the platinum layer is a portion of platinum  
2 wiring formed on the insulating film.

1 5. The metallization stack of claim 1 wherein the integrated MEMS device is an optical  
2 MEMS.

1 6. The metallization stack of claim 1 wherein the integrated MEMS device is a Bio-MEMS  
2 device.

1 7. The metallization stack of claim 6 wherein the platinum layer forms a corrosive resistant  
2 electrode.

1 8. The metallization stack of claim 7 wherein the electrically conductive structure is a  
2 conventional interconnect of the Bio-MEMS device.

1 9. A method of forming a metallization stack for use as a contact structure in an integrated  
2 MEMS device, the method comprising:

3 forming a titanium-tungsten layer that operatively contacts an electrically  
4 conductive structure in the integrated MEMS device, and

5 forming a platinum layer over the titanium-tungsten layer.

1 10. The method of claim 9 further comprising:

2 forming a platinum silicide on a surface of a semiconductor substrate; and

3 wherein the electrically conductive structure is an active silicon element formed  
4 in the semiconductor substrate and the titanium-tungsten contacts the active silicon  
5 element via the platinum silicide.

1 11. The method of claim 10 wherein the forming a platinum silicide step further comprises:

2 depositing an insulating film on the substrate surface;

3 etching a contact hole in the insulating film;

4 depositing platinum in the contact hole such that the platinum contacts an  
5 exposed portion of the surface of the semiconductor substrate at a bottom of the contact hole,  
6 and

7 forming the platinum silicide only on the exposed portion of the surface of the  
8 semiconductor substrate utilizing the deposited platinum.

1 12. The method of claim 10 wherein the forming a titanium-tungsten layer step further  
2 comprises:

3 depositing titanium-tungsten on the semiconductor substrate including the  
4 platinum silicide;

5 depositing a hardmask material over the titanium-tungsten;

6 removing the hardmask material except for a portion of the hardmask material  
7 above the platinum silicide;

8 removing the titanium-tungsten except for a portion of the titanium-tungsten  
9 under the hardmask material above the platinum silicide, and

10 removing the hardmask material above the platinum silicide.

1 13. The method of claim 12, wherein the hardmask material is AlCu.

1 14. The method of claim 9, wherein the forming a platinum layer step further comprises:

2 depositing platinum on the semiconductor substrate including the titanium-  
3 tungsten layer;

4 depositing an oxide hardmask over the platinum;  
5 removing the oxide hardmask except for a portion of the oxide hardmask above  
6 the titanium tungsten layer;  
7 removing the platinum except for a portion of the platinum under the oxide  
8 hardmask above the titanium-tungsten via a combination of dry etching and wet etching, and  
9 removing the portion of the oxide hardmask above the titanium-tungsten layer.

1 15. The method of claim 14, wherein platinum is removed in the removing the platinum step  
2 by sputter etching the platinum in argon followed by wet etching in aqua regia.

1 16. The method of claim 9, wherein the steps further comprise:  
2 depositing an insulating film on the substrate surface;  
3 etching a contact hole in the insulating film;  
4 depositing platinum in the contact hole such that the platinum contacts an  
5 exposed portion of the surface of the semiconductor substrate at a bottom of the contact hole;  
6 forming a platinum silicide only on the exposed portion of the surface of the  
7 semiconductor substrate utilizing the deposited platinum;  
8 depositing titanium-tungsten on the semiconductor substrate including the  
9 platinum silicide;  
10 depositing a hardmask material over the titanium-tungsten;  
11 removing the hardmask material except for a portion of the hardmask material  
12 above the platinum silicide;

removing the titanium-tungsten except for a portion of the titanium-tungsten  
under the hardmask material above the platinum silicide;  
removing the hardmask material above the platinum silicide;  
depositing platinum on the semiconductor substrate including the titanium-  
tungsten layer;  
depositing an oxide hardmask over the platinum;  
removing the oxide hardmask except for a portion of the oxide hardmask above  
the titanium tungsten layer;  
removing the platinum except for a portion of the platinum under the oxide  
hardmask above the titanium-tungsten via a combination of dry etching and wet etching, and  
removing the portion of the oxide hardmask above the titanium-tungsten layer.

17. The method of claim 9 wherein the platinum layer and titanium-tungsten layer are  
formed by a single plasma etch.

18. The method of claim 9 wherein the integrated MEMS device is an optical MEMS.

19. The method of claim 9 wherein the integrated MEMS device is a Bio-MEMS device.

20. An integrated MEMS device comprising a metallization stack having a contact layer of  
platinum and an adhesion layer of TiW.

1 21. The integrated MEMS device of claim 20 wherein the integrated MEMS device is an  
2 optical MEMS device.

1 22. The integrated MEMS device of claim 20 wherein the integrated MEMS device is a Bio-  
2 MEMS device.

1 23. An integrated MEMS device, the device comprising:  
2 a semiconductor substrate having an insulating film formed thereon  
3 a contact hole formed in the insulating film;  
4 a platinum silicide layer formed at the surface of the semiconductor substrate  
5 exposed at a bottom of the contact hole;  
6 a titanium-tungsten layer formed on the platinum silicide, and  
7 a platinum wire formed on the insulating film, the platinum wiring including a  
8 portion formed on the titanium-tungsten layer.

1 24. The integrated MEMS device of claim 23 wherein the integrated MEMS device is an  
2 optical MEMS.

1 25. The integrated MEMS device of claim 23 wherein the platinum wire is formed by:  
2 depositing platinum on the insulating film and the titanium-tungsten layer;  
3 depositing an oxide hardmask over the platinum;  
4 removing the oxide hardmask except for a portion of the oxide hardmask where  
5 the platinum wire is to be formed;

6 removing the platinum except for a portion of the platinum under the remaining  
7 oxide hardmask via a combination of dry etching and wet etching, and  
8 removing the remaining oxide hardmask.

1 26. The integrated MEMS device of claim 25 wherein the platinum is removed by sputter  
2 etching the platinum in argon followed by wet etching in aqua regia.

1 27. A method of patterning platinum for fabricating a semiconductor device, the method  
2 comprising:

3 depositing platinum on a semiconductor substrate;

4 patterning the platinum using an oxide hardmask;

5 etching the platinum using a combination of dry etching and wet etching.

1 28. The method of claim 27 wherein the combination of dry etching and wet etching  
2 comprises sputter etching the platinum in argon followed by wet etching the platinum in aqua  
3 regia.

1 29. The method of claim 27 wherein the patterning step further comprises:

2 depositing the oxide hardmask on the platinum;

3 patterning the oxide hardmask using a photoresist;

4 etching the oxide hardmask according to the pattern such that portions of the  
5 oxide hardmask are removed to expose the platinum in areas where the platinum is to be

- 6 removed while leaving portions of the oxide hardmask in areas where patterned platinum is to be  
7 formed, and removing the photoresist.

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